## CHEMICAL NOTES

In a paper communicated by Prof. Mendeléeff to the last issue of the *Journal* of the Russian Chemical Society, being a reply to M. Avenarius, the Professor makes a very interesting comparison between his own formula of dilatation of liquids and the logarithmic formula of Waterston, supported in Russia by his opponent, M. Avenarius. He shows by analysis why both formulas express with sufficient approximation the expansion of ether within the limits of 0° and 104°, the observations beyond that limit having to be left aside until we have a more accurate knowledge of the laws of expansion of this substance at higher temperatures and under higher pressures. He demonstrates, moreover, that the logarithmic formula is as inapplicable to water as his own; and, developing both formulas into series, he shows why his own simpler formula ought to be considered as a first approximation to the law of dilatation of liquids until the true law is discovered. Though polemic in its first part, the paper is a masterly piece of scientific treatment of the controversy about so important a question.

Following on the lines laid down by Mr. H. B. Dixon in his experiments on the combustion of carbonic oxide in dry and in moist oxygen, Mr. H. Brereton Baker has recently described some very interesting results regarding the combustion of phosphorus and carbon in oxygen. When the elements in question were heated in oxygen which had been kept in contact with phosphorus pentoxide for some weeks, combustion occurred only to a very limited extent. The presence of a small quantity of water-vapour seems to be needed in order to start the combustion (*C. S. Journal, Trans.*, 1885, 349).

The influence of the relative masses of the reacting bodies on chemical changes has of late years received a good deal of attention. Urech has discussed the well-established data regarding the influence of dilution, and of the presence of excess of one or other ingredient, on chemical reactions (*Ber.*, xviii. 94). He points out that the diluent may act both physically and chemically. When it acts altogether as a diluent it does not, according to Urech, affect the rate of the chemical operation. Excess of either reacting body appears always to exert an influence on the rate of change. The causes of the variations in the rate of chemical change are probably very complicated; even the shape and character of the containing vessel may exert an appreciable effect.

Experiments are described by M. J. Thoulet (*Compt. Rend.*, xcix. 1072) on the effect of immersing various solid bodies in saline solutions, *e.g.* marble, quartz, &c., in aqueous solutions of sodium or barium chloride. In each case a portion of the dissolved salt was precipitated on the surface of the immersed solid. The conclusion is drawn that there is an attraction between the dissolved salt and the solid immersed, and that the amount of attraction is proportional to the surface of the solid.

Some time ago Mr. Bayley showed that when drops of various solutions are allowed to fall on to filter-paper, the salt which was in solution in many cases remains in the centre, and a water-ring extends around it. Mr. J. U. Lloyd has extended these observations (*Chem. News*, li. 51). He has observed the distances to which various substances in aqueous solutions extend on pieces of blotting paper, dipped into the solutions, before they are left behind by the water. Great differences were noticed in the length to which different salts thus travelled. Mixtures of salts were also examined; in some cases one salt passes on, leaving the other completely behind. Thus a solution of quinine and berberine sulphates was separated by the method described; the former salt passed on through the paper after the progress of the latter had quite ceased. Dilute sulphuric acid behaved similarly; pure water alone passed onwards. In the case of simple salts dissolved in water, the rule appears to be that the more dilute the solution, the quicker is the separation into salt and water.

Chemists are beginning to realise that the structural formulæ they have so long regarded as final expressions are, after all, very imperfect representations of chemical operations. The molecule of a compound has been treated as a structure built up of atoms; in their anxiety to learn the relations of these atoms chemists have almost forgotten that the molecule is itself a whole. Attention has of late been recalled to this aspect of molecular formulæ. Hartley's researches on "the relation between the molecular structure of carbon compounds and their absorption spectra" have led to results of much interest in this direction. In a paper communicated to the Chemical Society on May 7, Hartley brought forward a series of facts which lead to the conclusion that "molecules vibrate as wholes or units, and the fundamental vibrations give rise to secondary vibrations which stand in no obvious relation to the chemical constituents of the molecule, whether these be atoms or smaller molecules. Hence it appears that a molecule is a distinct and individual particle which cannot be truly represented by our usual chemical formulæ, since those only symbolise certain chemical reactions and physical properties, and fail to express any relations between physical and chemical properties."

Nasini (*Atti d. Acc. d. Lincei Rdct.*, 1885, 74) has been pursuing his inquiries regarding the "atomic refraction" of sulphur in various compounds, and has obtained results which lead him to conclude that the variations in the refraction-equivalents of sulphur compounds cannot be explained by the ordinary structural formulæ employed in chemistry. These variations appear to be connected neither with the valency of the sulphur-atom in the different molecules, nor with the nature of the other atoms which are associated with the atoms of sulphur. Changes in the structure of sulphur-containing molecules seem to be accompanied by changes in the refraction-equivalents of these molecules, but these changes cannot be regarded as due to variations in the valency, or arrangement, of the atom of sulphur they must rather be attributed to some cause which affects the molecule as a whole.

We notice a very interesting and important discussion raised in the *Journal* of the Russian Chemical Society (vol. xvii. 3) by Prof. A. Butleroff, with regard to Prof. Menshutkin's explanation of isomerism by "substitution." M. Butleroff very ably advocates the theory of "structure," *i.e.* of a combination of molecules, instead of atoms, and of compound molecules with atoms. The chief principles advocated by the author appear as follow:—We are right in speaking, as of a real thing, about mutual chemical relations between atoms and molecules; and it is only by admitting some differences in these relations (some differences in the manner of their "union") that we can explain the phenomena of isomerism. These differences are constant, permanent to the molecules; they are their inseparable characteristic attributes. These principles being admitted, the author deduces from them the following conclusions:—"(1) The scheme of substitution (advocated by Prof. Menshutkin) permits rightly to foresee and formulate isomerides only when the structure is supposed known; (2) it requires auxiliary hypotheses, and it is devoid of simplicity and lucidity; (3) the fundamental ideas, both of the theory of substitution as applied to organic bodies and of that of chemical structure, are the same; therefore the former gives nothing new which is not given by the latter; (4) being narrower and more one-sided, when applied to isomerism in organic bodies, the former—if it be applied alone—does not in many instances foretell certain phenomena which are simply and easily foreseen by the theory of chemical structure."

## GEOGRAPHICAL NOTES

A British Mission from India is being sent to Cashmere in charge of Col. Lockhart, who is accompanied by Major Woodthorpe, Capt. Barrow, and Dr. Giles, and an escort consisting of two non-commissioned officers and twenty men. The chief object of the Mission is to obtain further geographical information concerning the countries on the northern and western frontiers of Cashmere. It will visit Chitral and the neighbourhood of that place, and will be absent for several months.

M. Leonardo Féa, of the Museum of Natural History at Genoa, has been despatched by the Italian Government on a scientific journey to Burmah. He is to make zoological collections, and also to make various scientific observations. He was provided with letters to the Burmese Government at Mandalay. The Geographical Society of Rome has received from Capt. Molinari reports of two journeys which he has recently made in the Shan States.

At the usual meeting of the Dutch Aardrijkskundig Genootschap on April 18, a general view of those parts of New Guinea was given to which the Society wishes to send an expedition. The Government has promised a grant not exceeding 10,000 florins a year, and under such circumstances the expedition is to be confined to geographical investigations. Particulars could not yet be given, since the proposals of the Society were

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still under consideration with the Government in the Dutch Indies. It was mentioned, however, that the expedition would probably go to Doreh or to Onin; many offers to accompany it have been made to the Society.

AT a recent meeting of the Paris Geographical Society, M. Romanet du Caillaud described the life and travels of Ordoñez de Cevallos, who was born at Jaen towards the middle of the sixteenth century, and who commenced his journeys all over the world at the age of seventeen. He visited various countries in Europe, and travelled several times to both Americas. He then became a priest, without, however, renouncing his dominant passion. He went as missionary to the Philippines, thence to Canton and Japan. From Japan he set sail for China again, but a storm drove him on the coasts of Tonquin. Having received permission to land, he went to the Court in 1590, and visited various parts of the Indo-Chinese peninsula, Malacca and India. He started then for Buenos Ayres, touching at the Cape of Good Hope, and endeavoured to go to the west coast of South America by the Straits of Magellan, but was prevented by an English fleet, which barred the Straits. He returned to Buenos Ayres, and in 1595 undertook a journey, similar to that in which Crévaux lost his life, by Tucuman, the Paraguay, Potosi, &c., preaching by the way to the savage tribes, whom he calls the Quixos, Omaguas, &c. He fought also agains the black Indian cannibals, called by the Spaniards the Gimarrons or Caribs. Ultimately he returned to Seville and became a canon. In 1607 the Bishop of Macao gave him a message from the King of Tonquin desiring him to return to that country, but he could not do so. The works of this indefatigable traveller are: (1) "Historia y Viage del Mundo"; (2) "Relaciones verdaderas de los Reynos de la China, Cochinchina, y Champaa" (Jaen, 1628); (3) "Triunfos de la Santissima Cruz"; (4) "Descriptio Indiæ Occidentalis," in the "Novus Orbis sive descriptio Indiæ Occidentalis" of Antonio de Herrera (Amsterdam, 1622).

A BLUE-BOOK just issued by the Foreign Office contains five maps referring to the Russo-Afghan boundaries. The first is a chart of the routes followed by members of the Boundary Commission from Kushan to Bala Murghab; the second is a reproduction in English of a Russian military map of the frontier; No. 3 is a copy of a map of South-Western Turcomania, produced in Russia; No. 4, which was prepared by M. Lessar, shows his explorations; while the last is a sketch map to illustrate the various zones and lines of frontier proposed at one time or other recently by Russia and England.

The Austrian Tourist Club has appointed a committee with the view of making experiments for the improvement of the natural drainage of certain parts of the Karst which are liable to periodical inundation. This celebrated region in the north of the Adriatic is remarkable for its underground rivers, which communicate with the surface here and there by vertical shafts. Through these openings the surplus waters escape to the surface when the underground channels are filled to overflowing, and in that way considerable tracts are periodically converted into temporary lakes. The well-known Lake Zirknitz is only one of dozens of such lakes that are formed in this district every year. The practicability of preventing these inundations by enlarging the underground channels has been discussed on several occasions in the Tourist Club, and now the first attempt to carry this scheme into effect is about to be made with the Pinka Jama, a natural shaft leading down to an underground channel about a mile and a half from the Adelsberg Cavern.

HERR GLASER, the Austrian explorer, is about to undertake a new journey in Southern Arabia. He will go first from Sanaa to Marib, and will then visit in succession Wadi-Davassir, Nedjd, Omaun, and Hadramant. In a similar journey which he made some time ago he brought back 276 inscriptions of the Sabeans, who were regarded in the time of the Ptolemys as the wealthiest people of Arabia.

CAPT. JENNINGS of the Royal Engineers, has returned to India (according to the *Pioneer*) after a successful exploration of South-eastern Persia, including the hitherto unknown Sarhad country. He carefully examined all the roads and the configuration of the country, and is said to bring back a mass of useful information with regard to this region.

THE last number (xx.) of the *Excursions et Reconnaissances* of Saigon contains, among others, two papers by that indefatigable student of Indo-China, Capt. Aymonier, one on Cambodian epigraphy, the other on a journey in Laos. Dr. Tirant gives the second part of his paper on the reptiles of Cochin China and Cambodia, and M. Hardouin concludes the account of a recent journey in Siam.

*Petermann's Mittheilungen* (No. 5, 1885) contains a paper, accompanied by an excellent map, on Kaffraria and the eastern boundary lands of the Cape Colony, by Herr Schunke, some observations on the sanitary features of the Upper Amu-Darya, and an account of the Geographical Congress at Hamburg.

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## *A YEARLY AND A DAILY PERIOD IN TELEGRAPHIC PERTURBATIONS*

SINCE July 1, 1881, all disturbing currents at forty-four telegraphic stations in Norway and Sweden regarding time, duration, force, direction, &c., have been at my request regularly recorded. These observations will of course first obtain real importance when a longer series is available; still, I believe it would be of interest at present to investigate whether for these telegraphic perturbations a similar yearly and daily period could be established, such as have been proved for the aurora and other terrestrial magnetic phenomena. My time being now rather limited, extensive researches are not possible; of the mentioned forty-four stations I have therefore selected four, and herewith present the results of my investigations.

The four stations are named and located as follows:—

| | ° ′ | | ° ′ |
|---|---|---|---|
| Kistrand ... .. | 70 25 N. | ... | 25 13 E.G. |
| Lödingen ... ... | 68 24 ,, | ... | 16 1 ,, |
| Trondhjem... ... | 63 27 ,, | ... | 8 5 ,, |
| Bergen ... ... | 60 24 ,, | ... | 5 20 ,, |

My researches have been made for the three years from July, 1881, to June, 1884. As the Norwegian stations do not do night work, the observations could only be taken from 7 o'clock in the morning till midnight.

I have first noted the number of days for each month on which telegraphic perturbations have been observed, excluding those caused by thunderstorms. These numbers besider the totals for each month and year are shown in Tables I. to IV.

TABLE I.—*Kistrand*

| Month | 1881 to 1882 | 1882 to 1883 | 1883 to 1884 | Total |
|---|---|---|---|---|
| July | 1 | 2 | 8 | 11 |
| August | 0 | 12 | 3 | 15 |
| September | 7 | 12 | 11 | 30 |
| October | 14 | 20 | 6 | 40 |
| November | 10 | 22 | 3 | 35 |
| December | 13 | 8 | 3 | 24 |
| January | 5 | 7 | 0 | 12 |
| February | 7 | 10 | 9 | 26 |
| March | 13 | 16 | 4 | 33 |
| April | 25 | 6 | 12 | 43 |
| May | 19 | 4 | 3 | 26 |
| June | 14 | 5 | 5 | 24 |
| Year | 128 | 124 | 67 | 319 |

TABLE II.—*Trondhjem*

| Month | 1881 to 1882 | 1882 to 1883 | 1883 to 1884 | Total |
|---|---|---|---|---|
| July | 7 | 5 | 10 | 22 |
| August | 4 | 8 | 3 | 15 |
| September | 10 | 6 | 3 | 19 |
| October | 15 | 11 | 6 | 32 |
| November | 11 | 16 | 6 | 33 |
| December | 14 | 6 | 5 | 25 |
| January | 12 | 7 | 1 | 20 |
| February | 16 | 10 | 4 | 30 |
| March | 18 | 8 | 7 | 33 |
| April | 14 | 4 | 2 | 20 |
| May | 17 | 2 | 1 | 20 |
| June | 6 | 6 | 3 | 15 |
| Year | 144 | 89 | 51 | 284 |

The monthly totals for the three years are graphically represented in Fig. 1. Both the numbers and the figure show apparently that the yearly period for the telegraphic perturbations is identical with that of the aurora, *i.e.* its maximum coincides with both solstices and its minimum with both equinoxes. Of especial importance is the minimum at the time of the summer solstice, when the aurora, as is well known, ceases, on account of the

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